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and its languages had years before been excellently described and studied by Sir George Grey and by Advocate-General Moore; and, from their records, it appeared that the natives spoke of a spirit, "Mittagong," who, was, however, an insignificant demon identified with phosphoric fungus. As for "Chenga," he was not an individual at all. The dead, or the spirits of the dead, were called "djanga," and this word was applied by the savages to the white men, whom they regarded as the spirits of their forefathers returned. This misapplication of the name of a class to a particular person was largely due to the fact that communication between savages and white men was carried on in dog-English, when a few words were strung together without particles or inflections. Thus the savage, living in terror of beings closely corresponding to our ghosts or demons, learned to use the word "devil" in connection with them. The white man, accustomed to the ideas of a dominant Satan, wrote the word in his note book with a capital letter, unconscious that he was thus converting the savage's simple belief in spirits into a dualistic religion where a great personal evil was opposed to the great good being.

The German Moravian missionaries who went into the interior of Victoria in 1850 recorded that they found among the natives a belief in a spirit, "Baiaime," the creator of all things, who dwelt above the clouds. Mr. W. Howitt also described this "Baiaime" as he found him, and gave the following account, told by a native sorcerer, who had, according to custom, gone to "Baiaime" for instruction in the supernatural: "My father had said we will go to 'Baiaime's' camp. He got astride of a thread, and put me on another, and we held by each other's arms. At the end of the two threads was 'Wambu,' the bird of 'Baiaime.' We went through the clouds, and on the other side was the sky. We went through the place where the doctors go through, and it kept opening and shutting very quickly. My father said that, if it touched a doctor as he was going through, it would hurt his spirit, and, when he returned home, he would sicken and die. On the other side, we saw 'Baiaime' sitting in his camp. He was a very great old man, with a long beard. He sat with his legs under him, and from his shoulders extended two great quartz crystals to the sky above him. There were also numbers of the boys of 'Baiaime' and his people, who are birds and beasts." These details were in some respects of very native character, while in others recalling conventional Christian pictures of the Almighty.

After adducing other illustrations from the records of explorers in Australia and Tasmania, Dr. Taylor concluded his paper by saying that, in examining a good many savage religions, he had come to the same result. In the religion of the lower races the civilized observer found himself on a familiar ground among ghosts, fairies, devils, and deities of the sky, of the sun, and of the river. Therefore, native religions extended to the distinct appreciation of gods of high rank in a polytheistic system; but to go one step further, and to look for any ideas of one supreme good being and one potent evil being, was to get beyond the religion of the lower races altogether.

#### AGRICULTURAL LOSSES FROM INSECTS.<sup>1</sup>

At the last meeting of the association, in Champaign, Ill., I had the honor of a conversation with assistant secretary, the Hon. Edwin Willits, and he mentioned that he was frequently asked for information as to the advisability of

<sup>1</sup> From address of James Fletcher, president, at the third annual meeting of the Association of Economic Entomologists.

large expenditures for entomological purposes, and that, although entomologists frequently spoke of the large losses from insects, we did not provide politicians — and particularly himself — with data by which they could explain and justify these expenditures, which those who understood them knew to be of such enormous importance, and when we wished to point out the great injuries done by insects we had to go back continuously to old published records which we had all been quoting for upwards of ten or twenty years. Now we find upon investigation that accurate estimates of damage done by insects are exceedingly difficult to arrive at, and the figures are so large that we are rather afraid to quote them ourselves lest we should prevent rather than encourage investigation, and it has been the custom of entomologists to minimize the estimates for fear they should not be believed. Now the necessity has arisen, I think, and I lay it before the association for action, in the direction of gathering together some reliable recent statistics in a short form which may be printed for distribution, and which will cover the more important injuries to date, and the part the work of the entomologist has played in reducing injury or preventing loss, so that we may overcome this difficulty and provide legislators and ourselves with data with which to meet this argument. After a careful examination and great effort to obtain data I have found that there are certain of these large estimates which appear to be reliable. I think better results will follow the publication of a few quite reliable statistics, which may be taken as typical instances, than by accumulating a large number of items which would increase the chance of error and might not be read so carefully. By way of example, I will refer to the chinch bug. I have examined carefully the estimates which have been published concerning that particular insect, and the following are probably quite reliable and appear to have been made with due regard to all collateral considerations, as the increased value of the saved crops, the cost of remedial measures, and similar subjects.

In 1864 Dr. Shimer's estimate, which I find was drawn up with very great care, put the loss in the one State of Illinois to the corn and grain crops at \$73,000,000. In Dr. Riley's "Reports on the Injurious Insects of Missouri," we find in 1874 there was a reliable estimate of the loss to that State by the same insect of \$19,000,000. In 1887 Professor Osborn's estimate, founded upon the reports of the correspondents of the State Agricultural Society of Iowa, put the loss in that State on corn and grain at \$25,000,000; and, last, Mr. Howard's estimate, as given in the entomologist's report for 1887, for the nine States infested by the chinch bug in that year, was \$60,000,000.

Now, gentlemen, I think that these statistics of the injuries to crops by one insect alone are probably as reliable as any we can get, and they give a good argument which we may use as showing the depredations of insects; but it is not sufficient that we can convince people that great injury is going on, we must show that we are doing something to mitigate this injury. In Professor Comstock's report for 1879 the estimate of the possible loss in years of general prevalence of the cotton Aletia is placed at \$30,000,000 through the cotton States. The injuries by grasshoppers in the different States of the Union, and also occasionally through the British North American provinces, have been so enormous that figures hardly give an idea of the injury they do, but they are known by all to be enormous.

As an instance, however, of what may be done to mitigate their attacks, I would merely mention those for this year,

which seem to have been very considerable. In the States of North Dakota and Minnesota it is probable that at least \$400,000 have been saved on account of work done by direct advice of entomologists — work they have in some instances forced upon the farmers. Two hundred thousand dollars is a probable estimate of the amount saved by ploughing the land last autumn. Another equal amount has been saved by the use of "hopperdozers." Professor Bruner tells me that a sufficient number of grasshoppers have been actually taken this year, which, if left alone and allowed to lay their eggs, might next year have devastated the whole crops of these two States and the adjoining parts of Manitoba. These successful operations have been carried on by the State entomologist of Minnesota, Professor Lugger, and by Professor Waldron of North Dakota, ably aided by the advice and assistance of the agent of the Department of Agriculture, Professor Bruner, under Professor Riley's instructions; and I think it is no exaggeration to say that at least \$400,000 have been actually saved in hard cash on this year's crop, not to speak of the enormous loss which would most probably have followed next year had they been left alone, and had climatic conditions been favorable for their increase.

The amount of damage done to crops every year is so vast that the figures excite incredulity from those who do not study crop statistics. The agricultural products of the United States are estimated at about \$3,800,000,000. Of this it is thought that about one-tenth is lost by the ravages of insects. This is in many cases unnecessary. In short, a sum of \$380,000,000 is given up without a murmur and almost without a struggle by the people of the United States.

Crops of all kinds are injured, and simple remedies are known for many of the attacks, and are more or less adopted. Some have already come into general use. Paris green is now applied to potato fields almost as much as a matter of course, as manure is to fertilize the soil. As an instance of how a saving may be made even in well established methods, I give the following: Through the work of Mr. W. B. Alwood of the Virginia Experiment Station, improved machinery and the water mixtures of poisons have come into general use among the farmers and potato-growers in the Norfolk region, and some of the largest growers now claim that they at present do for from \$40 to \$60 what used to cost them from \$500 to \$600. To-day, in California and Florida, orange trees are universally treated with kerosene and resin emulsions or poisonous gas for scale insects.

In the treatment of cabbage caterpillars, pyrethrum diluted with four times its weight of common flour, and then kept tightly closed for twenty-four hours, leaves nothing to be desired, and thousands of dollars are yearly saved to small growers who most need the assistance.

• Many excellent remedies have been devised by a mere modification of existing agricultural methods. Instances of these are found in the early and late sowing or harvesting of some crops, as sowing turnips between the broods of the turnip flea-beetle, the late planting of cabbage for the root-maggot, the late sowing of wheat for the Hessian-fly, etc. In the 1879 Report of the United States Department of Agriculture was first detailed the only successful method of treating the clover-seed midge by cutting or feeding off the first crop before the young larvæ are sufficiently matured to leave the heads and go into the ground to pupate. This was simply a change of one week, by which not only is the insect destroyed, but the clover is saved in better condition than under the old method.

During the present summer Professor Osborn has discov-

ered that a serious pest of the clover plant, *Grapholitha interstinctana*, a small moth, may be destroyed in all its stages by simply stacking the hay soon after it is cut.

In the Southern States Mr. Howard Evarts Weed writes to me with regard to the cotton worm: "The loss would indeed be great were it not for the fact that the planters keep it in check by the prompt application of Paris green in a dry form. The only method now used is to apply it by means of two sacks attached to a pole and borne through the plantations by a negro mounted on a mule, who rides down the rows of plants. This gives perfect satisfaction, and the farmers of the State tell me that they want no better remedy for this insect."

Mr. F. W. Mally writes on the same subject: "The benefit which the public generally derives from the researches of economic entomologists is well illustrated by the result of the cotton-worm investigation published in the fourth report of the United States Entomological Commission. In that report estimates of damage, etc., are given, and I will only allude to the benefit which the planters have derived from the report. Formerly, planters waited until the August brood of the *Aletia* issued and depredated on their cotton. This brood may be called the migratory one, since it spreads over vast areas of cotton fields. At that time, too, the planters used Paris green just as they purchased it from the dealers. They have now been educated to know that the *Aletia* propagates in certain quite well-defined centres earlier in the season, and that if taken in July (or about five weeks earlier than they had been accustomed to), they can prevent their spreading to larger areas. Now, too, they dilute the Paris green with flour and finely-sifted wood ashes, greatly reducing the cost of the poison per acre. At the same time the acreage or area to which poison is now applied has been reduced tenfold; at least. For example, here in the Red River Valley, for 30 miles up and 50 miles down the river in July there were only two plantations (together about 2,000 acres) upon which *Aletia* was found. In August this brood would have spread over almost the entire section mentioned. Paris green was applied to this limited infested area, and the larger areas saved from injury. The saving is hardly to be estimated. The above appears to me to be one of the greatest triumphs of economic entomology, and, I may truthfully say, also of my most estimable chief, Dr. C. V. Riley."

With regard to another injurious insect, the following facts well illustrate what may be done by following the advice of an experienced entomologist.

During the year 1885 the Hon. Moses Fowler, a wealthy banker and landowner of Lafayette, Ind., applied to Professor F. M. Webster, an agent of the United States Department of Agriculture, then located at that place, for relief from very serious depredations by an unknown enemy to his corn, which was damaging some of his fields from 5 to 75 per cent, he having this year 10,000 acres of land devoted to this crop. Upon examination the depredator proved to be the well-known corn-root worm, the larva of *Diabrotica longicornis*. Mr. Fowler estimated the loss in his fields by reason of this insect at \$10,000, with a probability of still greater injury the following year. On the advice of Mr. Webster, the next season he sowed 5,000 acres of the worst infested lands to oats, and the following year the other 5,000 acres was treated in the same manner, the first 5,000 acres being this year again devoted to corn. As a result of a continuation of this rotation the pest has been practically exterminated, thereby, according to Mr. Fowler's estimate, saving him \$10,000 per annum.

Professor Osborn has shown that grass insects destroy much produce. He estimates that the small leaf-hoppers (*Jassideæ*) destroy as much food from two acres of pasture as would feed one head of stock. From recent experiments he has found that it is possible by the use of hopperdozers to reduce the numbers of these insects so materially that, upon two plots chosen for their similarity of the conditions of the growth, the amount of hay produced upon a plot which was once treated with the hopperdozer was 34 per cent greater than upon the corresponding untreated plot.

#### VIRCHOW, THE MAN AND THE STUDENT.<sup>1</sup>

By his commission the physician is sent to the sick, and, knowing in his calling neither Jew nor Gentile, bond or free, perhaps he alone rises superior to those differences which separate and make us dwell apart, too often oblivious to the common hopes and common frailties which should bind us together as a race. In his professional relations, though divided by national lines, there remains the feeling that he belongs to a Guild which owes no local allegiance, which has neither king nor country, but whose work is in the world. The Æsculapian temple has given place to the hospital, and the priestly character of the physician has vanished with the ages; still there is left with us a strong feeling of brotherhood, a sense of unity, which the limitations of language, race, and country have not been able to efface. So it has seemed meet and right to gather here this evening to do honor to a man — not of this country, not of our blood — whose life has been spent in the highest interests of humanity, whose special work has revolutionized the science of medicine, whose genius has shed lustre upon our craft.

The century now drawing to a close has seen the realization of much that the wise of old longed for, much of which the earnest spirits of the past had dreamt. It has been a century of release — a time of the loosening of bands and bonds; and medicine, too, after a long enslavement, ecclesiastical and philosophical, received its emancipation. Forsaking the traditions of the elders, and scouting the Shibboleth of schools and sects, she has at last put off the garments of her pride, and with the reed of humility in her hand sits at the feet of her mistress, the new science. Not to any one man can this revolution be ascribed; the *Zeit-geist* was potent, and like a leaven worked even in unwilling minds; but no physician of our time has done more to promote the change, or by his individual efforts to win his generation to accept it, than Rudolph Virchow.

And now, as the shadows lengthen, and ere the twilight deepens, it has seemed right to his many pupils and friends, the world over, to show their love by a gathering in his honor, on this his seventieth birthday. To-day, in Berlin, a *Fest* has been held, in which several hundred members of the profession in this and other countries have been participants, as subscribers to the fund which was organized for the occasion. It seemed well, also, to his pupils who are teachers in this university, and to others, that the event should be marked by a reunion at which we could tell over the story of his life, rejoice in his career, and express the gratitude which we on this side of the Atlantic feel to the great German physician.

Let me first lay before you a brief outline of his life:

Rudolph Virchow was born Oct. 13, 1821, at Schivelbein, a small town in Pomerania. Details of his family and of his childhood, which would be so interesting to us, are not available. Educated at the Gymnasium in Berlin, he left it at Easter, 1839, to begin his medical studies, and graduated from the university of that city in 1843. The following year he became assistant in pathological anatomy to Froriep; and in 1846 he was made professor, and in 1847 a lecturer at the university. In 1849, on account of his active participation in the political events of the previous year, he was dismissed from his university positions, and, as he mentions, was only *mit grossen beschränkungen* reinstated,

largely, in fact, by the efforts by the profession of Berlin, and particularly of the medical societies. In August, 1849, he received a call to the chair of pathological anatomy at Würzburg, a position which he held until 1856, when, by the unanimous vote of the faculty, he was recommended for, and received the appointment which he still holds, namely, professor of pathological anatomy at Berlin. Prior to leaving Berlin he founded, in 1847, his celebrated *Archiv*, now in its one hundred and twenty-eighth volume, which is the greatest storehouse of facts in scientific medicine possessed by us to day.

Externally, at least, an uneventful, quiet, peaceable life with few changes.

As an illustration of the successful pursuit of various callings, Virchow's career is without parallel in our profession, and this many-sidedness adds greatly to the interest of his life. Dr. Welch will speak of his special labors in the science of pathology; and other aspects will be considered by Dr. Chew and Dr. Friedenwald. I propose to indicate briefly a few traits in his life as a man of science and as a citizen.

From the days of the great Stageirite, who, if he never practised medicine, was at least an asclepiad and an anatomist, the intimate relation of medicine with science, has in no way been better shown than in the long array of physicians who have become distinguished in biological studies. Until the gradual differentiation of subjects, necessitated by the rapid growth of knowledge, the physician, as a matter of course, was a naturalist; and in the present era, from Galen to Huxley, the brightest minds of the profession in all countries have turned towards science as a recreation or as a pursuit. Alas! that in the present generation, with its strong bent toward specialism, this combination seems more and more impossible. We miss now the quickening spirit and the wiser insight that come with work in a wide field; and in the great cities of this country we look in vain among practising physicians for successors of Jacob Bigelow of Boston, Holmes of Montreal, Barton of Philadelphia, and others — men who maintained in this matter an honorable tradition, whose names live in natural history societies and academies of natural science, in the founding of which they were mainly instrumental.

In anthropology and archaeology the name of Rudolph Virchow is almost as well known as it is in medicine. Very early in his work we find evidences of this bent in the memorable studies, now forty years ago, on cretins and on the development of the skull. Not a year has passed since that time without some notable contribution from him on these subjects; and those of us who know only his professional side may well marvel at the industry of the man whose name is quoted and appears in anthropological memoirs and journals as often as in our technical works. In recognition of his remarkable labors in this department, a special anthropological institute was organized in 1881, on the occasion of the twenty-fifth year of his professoriate. In 1884, on returning to Berlin for the first time since my student days, I took with me four choice examples of skulls of British Columbian Indians, knowing well how acceptable they would be. In his room at the Pathological Institute, surrounded by crania and skeletons, and directing his celebrated *diener*, who was mending Trojan pottery, I found the professor noting the peculiarities of a set of bones which he had just received from Madeira. Not the warm thanks, nor the cheerful greeting which he always had for an old student, pleased me half so much as the prompt and decisive identification of the skulls which I had brought, and his rapid sketch of the cranial characters of the North American Indian. The profound expert, not the dilettante student, has characterized all of his work in this line. Even an enumeration with a brief report of his published writings in anthropological and archaeological subjects would take more time than has been allotted to me. Of his relations with Schliemann I must say something, which I could not do so well as in the words used by his friend, Dr. Jacobi, ten years ago: "Schliemann, by whose modern witchcraft holy old Troy is just leaving its tomb, invited Virchow to aid him in his work of discovery of the buried city. He went — partly to aid, partly, as he says, to escape from overwhelming labors at home — only to be engrossed in just as hard work, though of a different nature. In regard to the latter, Schliemann's recent book on

<sup>1</sup> Address by William Osler, M.D., professor of medicine in the Johns Hopkins University, on the seventieth birthday of Professor Virchow, Oct. 13, at Baltimore.